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FINAL REPORT



BASELINE STUDY OF THE EFFECTS OF BRINE DISPOSAL ON SELECTED MARINE ANIMALS

SURVEY No. 7

BY
TERECO CORPORATION
COLLEGE STATION, TEXAS

MAY 1982

Prepared for LOOP, Inc.

P. O. BOX 1159, Harvey, LA. 70059

Under Purchase Order 01895, as amended

A. J. HEIKAMP, Project Director



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RESULTS OF FIELD STUDY FOR LOOP, INC.

TerEco Survey No. 7

I. INTRODUCTION

OVERVIEW

The report in hand analyzes the results of TerEco Survey No. 7, which was carried out in the field off Louisiana by TerEco and LOOP personnel between April 15 and 20, 1982. Unlike the situation during Survey No. 6 (October 10 to 16, 1981) when extremely low dissolved oxygen (DO) concentrations were encountered in bottom water, oxygen levels were quite high. It was noted, however, that the DO concentrations at Stations 6 and 7 had dropped considerably on April 20. Moreover, the salinity was much higher at Station 7 than elsewhere, a fact that might indicate another invasion of the area by offshore water. This conjecture is supported by the observation that Stations 6 and 7 are the farthest offshore of the eight sampling stations (see Figure 1). In any event, it is to be noted that all DO levels were well above the critical 2.5 ppm levels that marks the onset of mortality from anoxia among the species used in our tests. It will be noted, however, that mortality among Fundulus was rather high at Stations 4 and 5. The only reasonable explanation is simply that some of the fish were not in good condition when placed in the BOMs. Since these were the last BOMs to be deployed, the fish had been held in rather crowded conditions for many hours. Environmental conditions are pretty well ruled out as causes, because neither shrimp nor Palaemonetes suffered particularly high mortality at these stations.

BOM PLACEMENT AND RETRIEVAL

In Survey No. 7, eight B-BOMs and two P-BOMs were deployed among the eight stations shown in Figure 1. One B-BOM was deployed at each of the eight stations, whereas P-BOMs were set only at the brine diffuser (Station 3) and at the control station (No. 8). Because bad weather moved across the

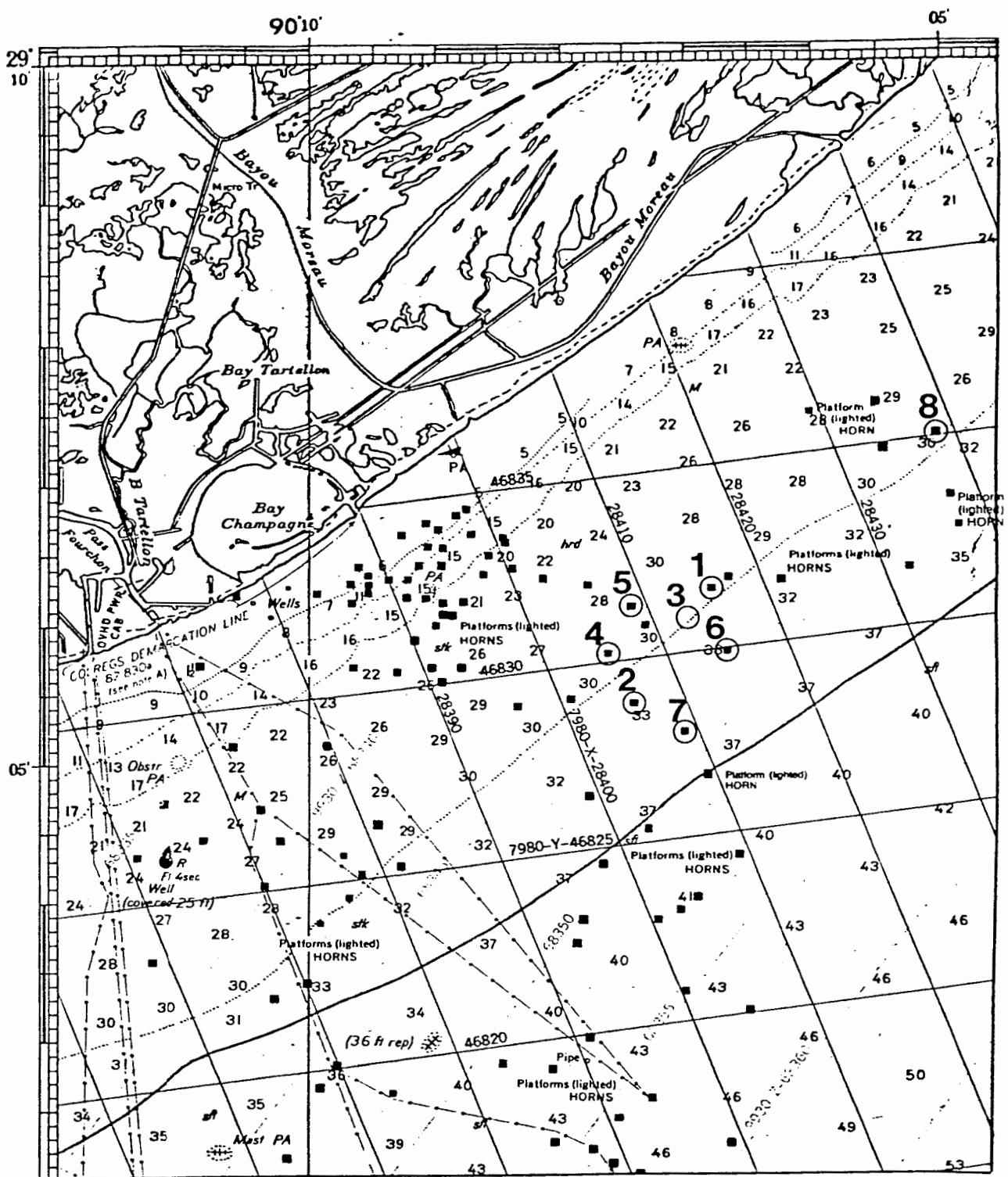


Figure 1. Map of the eight LOOP stations off the coast of Louisiana. Note that all stations are located adjacent to an oil platform except for Station 3 which is the location of the brine diffuser.

area on 18 April, retrieval originally scheduled for the 18th and 19th was delayed until the 19th and 20th so that the BOMs were out for four days (see Table 1).

MORTALITY OF TEST SPECIES DURING EXPOSURE

As indicated in the OVERVIEW, the only unusual mortality suffered by test species was among the Fundulus in B-BOMs at Stations 4 and 5 (see Table 2). Certainly this did not result from low DO or elevated salinities. Rather it is thought that the Fundulus were not in good condition by the time the BOMs were deployed at those stations, the last on the list. This conclusion is reinforced by the fact that the B-BOMs trapped more indigenous species of finfish and shellfish than ever before, and the largest number was at Station No. 5 (see Table 3).

TABLE 1
 Deployment and Retrieval of BOMs During LOOP Survey 7
 B = B-BOMs and P = P-BOMs
 Offshore Louisiana 1982

Date	Station Number (as in Figure 1)							
Deployment	1	2	3 (diffuser)	4	5	6	7	8 (control)
15 April 1982	B		B and P					
16 April 1982		B		B	B	B	B	
Retrieval	1	2	3 (diffuser)	4	5	6	7	8 (control)
18 April 1982		Foul weather and high sea state prevented pickup	B and P					
19 April 1982	B			B	B	B	B	
20 April 1982		B						
Days of Exposure	4	4	4	4	4	4	4	4

TABLE 2

Approximate Number of Test Species Placed in and Recovered
from BOMs During the April 1982 Survey No. 7
Deployed (DE); Retrieved (RE); Mortality on Retrieval (MOR)
(DOD) - Dissolved Oxygen in Bottom Water at Time of Deployment (ppm)
(DOR) - Dissolved Oxygen in Bottom Water at Time of Retrieval (ppm)
4-day Exposure Period

STATION NUMBER P-BOM and B-BOM	DOD		DOR		Fundulus grandis		Penaeus spp.		Palaeomonetes pugio	
					DE	RE	DE	RE	DE	RE
5	3P	3B*	12.00	9.00	60	56	0	0	60	+
		1B*	11.87	10.51	60	56	30	23	60	+
	8P	8B*	12.46	10.06	60	54	30	24	60	+
		7B*	11.16	6.08**	60	48	30	25	60	+
		2B*	--	--	60	49	30	22	60	+
		4B*	11.95	9.82	60	27	30	27	60	+
	5B*	11.50	10.40	60	28	30	23	60	+	+
	6B*	11.39	8.95	60	45	30	26	60	+	

+ Most alive

* See Table 3 for indigenous species trapped by B-BOMs

** Because salinity was quite high (see Table 5) it is assumed that this was offshore, low-oxygen water moving in. Note in Fig. 1 that Station 7 is farthest offshore of the eight stations.

TABLE 3
Indigenous Species Trapped in B-BOOMs During Survey No. 7
Numbers = Individuals Trapped

Species	Station Number						
	1	2	3	4	5	6	7
Toad fish	4	4	2	2	12	0	0
Cusk eel	4	3	1	4	2	4	11
Hard-head catfish	0	0	0	0	1	0	1
Crabs							0
Blue Stone Calico	9	17	8	16	25	17	10
Shrimp	1	2	1	0	2	0	12
Hermit crabs	0	2	0	0	0	0	0
Small sole	0	0	0	0	0	0	0
Worm eel	0	0	0	0	0	1	0
Mantis shrimp	0	0	0	0	0	1	0
Cancellariid gastropods and egg cases	+	+	+	+	+	+	+
No. of spp.	6	7	6	6	7	6	5
No. of ind.	20+	33+	15+	33+	44+	35+	23+

II. HYDROGRAPHIC CONDITIONS

WEATHER CONDITIONS

Weather conditions were generally satisfactory except on April 18 when because of high sea states LOOP personnel advised TerEco to delay retrieval of BOMs at Stations 1, 3, and 8 until the 19th. The daily account of weather during field work is as follows:

15 April: Skies overcast. SE breeze. Offshore seas running from SE at 2-3 ft. Wind SE up to 15 mph.

At diffuser. Sky overcast. Wind down at 0925 hrs. Seas running 3 ft with an occasional swell at 5 ft. Current running to NE.

At 1005 hrs gentle rain falling. Sky clear. Water is very dark colored and murky. Large amount of fine organic matter in upper layer.

At 1055 hrs sun is shining. Thin, high layer of scattered clouds. Haze. No white caps - swells 3 to 4 ft.

At 1155 hrs sky is very hazy. SE breeze to 10 mph. Swells SE up to 3 ft. Water very dark at Station 3.

16 April: At Fourchon Pass seas are rough. Ground swells up to 7 ft. Sky still hazy but no clouds. SE wind at 20 mph.

At 0925 hrs at the diffuser cloud cover about 40%. Seas running from ESE.

At 1120 hrs scattered clouds. Hazy bright at Station 5. Swells from SE 5-7 ft, occasionally 6-8 ft. Scattered white caps. Wind from SE up to 15 mph.

At 1330 hrs swells up to 10 ft as Pass is approached.

17 April: No field work scheduled.

18 April: LOOP cancelled BOM retrieval. Seas too rough due to front passage in the night. Winds from NNE at 20-25 mph.

19 April: Sky overcast with thin cloud layer. Foggy at Pass - 1/4 mile visibility.

At 0850 hrs seas only 1-2 ft at diffuser. Gentle breeze.

At 1010 hrs seas calm, slight SE breeze.

At 1210 hrs at Station 3 low swells running to NW. Breeze has died down.

20 April: At 0745 hrs thin scattered clouds. Slight breeze. At Pass seas running from SE at 2-3 ft. SE wind up to 12 mph.

At 1015 hrs hazy bright with full sun. Swells from SE up to 4 ft. Wind SE up to 15 mph at Station 4.

At 1330 hrs cloud cover developing and wind is increasing. Some white caps.

21 April: Leave for College Station.

TEMPERATURE

The mean surface water temperature during Survey No. 7 was below normal for the spring period. Averaging 21.93°C (Table 4) during BOM set and retrieval, it was characteristic of November temperatures rather than April. The mean bottom water temperature of 20.43°C was close to the 19.60°C of November 1980 than to the 23.76°C of April 1981. When this finding is coupled with the fact that the mean bottom water salinity was very low and dissolved oxygen very high, it is clear that this has been an unusual spring period.

SALINITY

The mean salinities of the surface waters during Survey No. 7 (21.11 o/oo during BOM set and 23.19 o/oo during retrieval) were the lowest recorded by far during any previous survey (Table 5). The previous lowest record was established in Survey No. 5 during the spring of 1981. At that time the corresponding mean salinities were 28.76 o/oo during BOM set and 29.98 o/oo during retrieval. Major fluctuations of salinity are, of course, characteristic of the estuarine/shelf complex, especially in spring when runoff of freshwater from land can be expected. The fact that the mean bottom-water salinities were also very low, indicates that any possible effect of brine disposal in the nearshore waters is easily swamped by natural phenomena.

DISSOLVED OXYGEN

Dissolved oxygen (DO) concentrations during Survey No. 7 were by far higher than any previously recorded by TerEco (Table 6). This can only mean that DO production by phytoplankton was very high. This correlates well with the salinity data when land and stream runoff would lower salinities but increase the input of such nutrients as phosphate, nitrate, and vitamin B₁₂, which are generally low in seawater and are thus limiting factors for phytoplankton growth.

TABLE 4

Mean Surface and Bottom Water Temperatures (°C)
at L00P BOM Stations During Seven Surveys

	<u>Survey 1</u>	<u>Survey 2</u>	<u>Survey 3</u>	<u>Survey 4</u>	<u>Survey 5</u>	<u>Survey 6</u>	<u>Survey 7</u>
	<u>Oct 79</u>	<u>Dec 79</u>	<u>Jun 80</u>	<u>Nov 80</u>	<u>Apr-May 81</u>	<u>Oct 81</u>	<u>Apr 82</u>
<u>Surface Water</u>							
During BOM set	27.00	17.46	28.97	21.44	25.04	27.99	21.90
During BOM pickup	24.50	15.21	27.14	21.50	25.72	26.36	21.96
<u>Bottom Water</u>							
During BOM set	26.79	16.30	27.77	19.58	23.37	28.17	19.99
During BOM pickup	26.41	16.25	25.73	19.62	24.14	27.21	20.86

TABLE 5

Mean Bottom Water Salinities (‰)
at L00P BOM Stations During Seven Surveys

	<u>Survey 1</u>	<u>Survey 2</u>	<u>Survey 3</u>	<u>Survey 4</u>	<u>Survey 5</u>	<u>Survey 6</u>	<u>Survey 7</u>
	<u>Oct 79</u>	<u>Dec 79</u>	<u>Jun 80</u>	<u>Nov 80</u>	<u>Apr-May 81</u>	<u>Oct 81</u>	<u>Apr 82</u>
<u>Bottom Water</u>							
During BOM set	32.90	31.96	31.69	33.61	33.09	34.63	29.01
During BOM pickup	30.88	24.99	34.13	31.84	33.03	33.86	31.73

TABLE 6

Means and Ranges of Dissolved Oxygen Concentrations (ppm)
 of Bottom Waters at the Eight Loop Stations
 During BOM Set and BOM Pickup
 During Loop Surveys 5, 6, and 7

	<u>BOM Set Dates</u>	<u>Survey No. 5</u>	<u>Survey No. 6</u>	<u>Survey No. 7</u>
	April 1981, Oct. 1981, April 1982	5.89	2.06	11.76
	Ranges	2.84 to 8.96	0.4 to 3.2	11.16 to 12.46
	<u>BOM Pickup Dates</u>			
	May 1981, Oct. 1981, April 1982	5.03	6.56	9.26
	Ranges	2.52 to 7.91	5.4 to 6.8	6.08 to 10.51

III. CHEMICAL ANALYSIS OF ORGANISMS

TRACE METALS

Tissues used for Trace Metal Analyses

The following tissues were utilized from the penaeid shrimp and Fundulus:

1. Penaeid Shrimp: muscle from tail section. Five tail sections were pooled to provide sufficient flesh for good analysis. Both the exoskeleton and "vein" were removed in sample preparation.
2. Fundulus grandis: muscle tissue and backbone from five individuals pooled per sample. Skin was flayed off and not included in the sample.
3. Each sample was analyzed on the AA spectrophotometer in triplicate.

Methodology

The method used for metal analyses has been documented in previous TerEco reports to LOOP (e.g., see pp. 8 and 9 in the June 1981 report) and will not be repeated here.

Results of Trace Metal Analyses

The results of the trace metal analyses are presented in Table 7 where they are compared with Survey No. 5, which was undertaken in the same period during 1981. Several points are worthy of mention:

- (1) Cadmium levels in both shrimp and fish were low at about the same low level as recorded during Survey No. 5 (Table 7).

TABLE 7

Means and Standard Deviations of Trace Metal Concentrations (ppm) in Muscle Tissue
 of Fundulus and *Penaeus* Held in P-BOMs and B-BOMs
 LOOP Survey No. 7 (April 1982) Compared with LOOP Survey No. 5 (April 1-May 1981)

Station	Cadmium		Zinc		Copper	
	No. 5		No. 7		No. 5	
			FUNDULUS		No. 7	
1 (B-BOM)	.07 ± .00	.06 ± .02	70.9 ± 5.3	117.0 ± 19.1	1.9 ± 0.3	4.4 ± 2.2
2 (B-BOM)	.07 ± .01	.05 ± .01	66.8 ± 1.6	106.0 ± 0.0	1.4 ± 0.1	2.8 ± 0.9
3 (B-BOM)	.10 ± .04	.02 ± .01	47.3 ± 3.7	93.0 ± 23.4	1.4 ± 0.1	2.6 ± 0.1
4 (B-BOM)	.05 ± .00	.04 ± .01	92.9 ± 7.4	126.0 ± 0.0	1.5 ± 0.4	2.2 ± 0.1
5 (B-BOM)	.09 ± .01	.10 ± .02	73.4 ± 6.2	123.0 ± 2.8	1.7 ± 0.1	2.9 ± 1.0
6 (B-BOM)	.08 ± .00	.08 ± .01	76.3 ± 9.4	138.0 ± 2.2	1.7 ± 0.1	2.7 ± 0.4
7 (B-BOM)	.07 ± .01	.03 ± .01	82.4 ± 1.0	149.0 ± 54.5	2.4 ± 0.5	2.3 ± 0.1
8 (B-BOM)	.08 ± .01	.05 ± .00	73.5 ± 9.9	92.0 ± 14.1	2.3 ± 0.7	2.4 ± 0.2
3 (P-BOM)	.06 ± .01	.04 ± .00	70.3 ± 10.3	102.0 ± 14.4	1.4 ± 0.1	2.4 ± 0.2
8 (P-BOM)	.07 ± .02	.04 ± .01	78.6 ± 21.4	89.0 ± 13.5	2.0 ± 0.0	2.1 ± 0.3
Reference Control	.06 ± .01	.08 ± .02	89.2 ± 16.4	107.0 ± 11.3	1.4 ± 0.3	3.28 ± 1.0
Mean of Means	.07	.05	74.7	113.0	1.74	2.7

PENAEUS	Cadmium		Zinc		Copper	
	No. 5		No. 7		No. 5	
			FUNDULUS		No. 7	
1 (B-BOM)	.11 ± .01	.07 ± .05	52.9 ± 3.5	42.7 ± 2.5	16.1 ± 2.6	20.9 ± 3.0
2 (B-BOM)	.08 ± .01	.06 ± .04	50.5 ± 0.7	48.4 ± 3.1	20.6 ± 3.0	23.9 ± 2.5
3 (B-BOM)	.08 ± .02	.14 ± .07	50.2 ± 0.7	46.8 ± 2.6	20.5 ± 2.9	26.6 ± 1.6
4 (B-BOM)	.09 ± .06	.10 ± .06	41.2 ± 0.7	37.5 ± 1.7	13.0 ± 6.2	18.7 ± 0.9
5 (B-BOM)	.14 ± .08	.12 ± .05	43.5 ± 1.3	45.9 ± 1.2	21.4 ± 2.3	22.9 ± 1.0
6 (B-BOM)	.06 ± .01	.05 ± .02	47.1 ± 0.7	44.6 ± 1.1	14.1 ± 1.9	23.7 ± 1.7
7 (B-BOM)	.09 ± .08	.05 ± .00	45.6 ± 1.7	42.4 ± 2.2	14.9 ± 0.8	20.1 ± 2.5
8 (B-BOM)	.06 ± .04	.08 ± .05	75.2 ± 20.4	29.5 ± 4.3	13.0 ± 2.5	22.8 ± 1.2
Reference Control	.09 ± .03	.10 ± .06	50.8 ± 3.4	43.7 ± 1.2	7.7 ± 1.0	22.7 ± 1.8
Mean of Means	.09	.09	51.4	42.4	15.9	22.5

- (2) Zinc concentrations in Fundulus were much higher in Survey 7. Partly this was due to the fact that values in the reference controls were higher. Moreover, shrimp showed no elevation whatsoever. Hence little significance is attached to the elevated levels in the fish.
- (3) Copper concentrations were higher than usual in both fish and shrimps, but little significance is attached to the fact since the reference controls were also high in copper.

Results of Hydrocarbon Analyses

The only unusual thing about the hydrocarbon analyses during Survey 7 was the high levels of aromatics found in the shrimp (B-BOMS) at Stations 3 and 5 (Table 8). If the exceptionally high value at Station 3 is removed from consideration, the mean value is about the same as noted during Survey 5. The source of the aromatics is not known. The large uptake appears to have had some effect on Penaeus, as noted by the adenylate energy charge values in Table 9.

TABLE 8
 Alkane and Aromatic Hydrocarbon Concentrations in Muscle Tissue
 of Fundulus and Penaeus
 LOOP Survey No. 5 (April-May 1981) Compared with Survey No. 7 (April 1982)

Station	Alkanes (ppm)				Aromatics (ppm) As Toluene			
	Fundulus		Penaeus		Fundulus		Penaeus	
	No. 5	No. 7	No. 5	No. 7	No. 5	No. 7	No. 5	No. 7
1B	.01	.11	.04	.05	1.55	1.30	1.16	0.30
2B	.01	.30	.05	.05	1.26	1.40	0.45	0.60
3B	.00	.08	.03	.04	2.77	1.20	3.13	11.40
4B	.01	.09	.05	.04	1.55	2.20	0.89	0.50
5B	.01	.10	.04	.22	0.83	0.30	1.22	4.10
6B	.01	.08	.06	.09	1.83	1.00	1.30	0.20
7B	.00	.10	.03	.07	2.93	1.20	1.26	0.50
8B	.00	.27	.03	.05	1.10	0.90	0.53	1.80
3P	.02	.20	--	--	1.02	0.40	--	--
8P	.00	.15	--	--	0.53	1.70	--	--
RF	.01	.12	.02	.11	0.89	0.70	2.99	1.4
Mean of Means	.01	.15	.04	.08	1.54	1.12	1.24	2.31

TABLE 9

Comparison of Means of Adenylate Energy Charge Ratios Between
 Survey 5 (April-May 1981) and Survey 7 (April 1982)
 Whole Grass Shrimp, Abdominal Muscle of Commercial Shrimp and
 Fundulus. Reference Control is Comprised of Specimens Preserved
 at Time BOMs are Loaded. Station 3 is at Brine Diffuser.

Station	Survey 5	Survey 7
GRASS SHRIMP		
1 (B-BOM)	.69 ± .12	.84 ± .05
2 (B-BOM)	.75 ± .09	.74 ± .02
3 (B-BOM)	.75 ± .08	.90 ± .06
4 (B-BOM)	.79 ± .02	.86 ± .08
5 (B-BOM)	.70 ± .03	.77 ± .03
6 (B-BOM)	.81 ± .03	.84 ± .03
7 (B-BOM)	.84 ± .02	.92 ± .10
8 (B-BOM)	.86 ± .03	.86 ± .04
3 (P-BOM)	.88 ± .03	.90 ± .08
8 (P-BOM)	.86 ± .02	.92 ± .08
Reference Control	.89 ± .04	.82 ± .07
Mean of Means	.79	.85
COMMERCIAL SHRIMP		
1 (B-BOM)	.82 ± .09	.70 ± .17
2 (B-BOM)	.89 ± .06	.86 ± .06
3 (B-BOM)	.87 ± .08	.65 ± .17
4 (B-BOM)	.83 ± .05	.88 ± .05
5 (B-BOM)	.87 ± .06	.79 ± .16
6 (B-BOM)	.90 ± .03	.90 ± .04
7 (B-BOM)	.92 ± .07	.82 ± .05
8 (B-BOM)	.96 ± .03	.78 ± .03
Reference Control	.93 ± .04	.87 ± .10
Mean of Means	.89	.81
FUNDULUS*		
1 (B-BOM)	-	.90 ± .20
2 (B-BOM)	-	.87 ± .07
3 (B-BOM)	-	.94 ± .05
4 (B-BOM)	-	no sample
5 (B-BOM)	-	no sample
6 (B-BOM)	-	no sample
7 (B-BOM)	-	.78 ± .05
8 (B-BOM)	-	.81 ± .02
3 (P-BOM)	-	.87 ± .09
8 (P-BOM)	-	.90 ± .05
Reference Control	-	.83 ± .20
Mean of Means		.86

* First time energy charge was analyzed for this species.

IV. ENERGY CHARGE AND METABOLIC ENZYMES

ADENYLATE ENERGY CHARGE

The adenylate energy charge ratio (EC) was determined on the grass shrimp and brown shrimp and, for the first time, on Fundulus. The results of EC, as shown in Table 9, are excellent for all three species, except for the low value of $0.65 \pm .17$ displayed by the Penaeus at Station 3. It should be noted, however, that neither the grass shrimp or Fundulus showed depressed values at the station. This reinforces the necessity of exposing more than one kind of organism in the BOMs. It is felt that the Penaeus acquired the burden of aromatics from the sediments, since neither grass shrimp nor Fundulus were in direct contact with the bottom and they did not acquire an unusually high body burden of these hydrocarbons.

METABOLIC ENZYMES

Cytochrome P-450/P-420

The cytochrome values showed nothing unusual during Survey 7 (Table 10). In fact, the Penaeus at Station 3 did not show any effect of the body burden of aromatics noted previously.

ATPase Values

As can be seen in Table 11, ATPase values in both Fundulus and Penaeus during Survey 7 do not differ significantly from those obtained during previous surveys. This continues to support the conclusion that PCBs are not significant contaminants in the sediments of the test stations.

Catalase Values

Catalase values during Survey 7 (Table 12) showed no significant changes from the reference controls.

TABLE 10

Mean Levels of Cytochrome P-450/420 Levels in *Fundulus* (liver), and
 Brown Shrimp (abdominal muscle) Exposed in P-BOMS and B-BOMS
 Survey Nos. 5 and 6 Data Compared with Survey No. 7

Station	Cytochrome P-450/420, nanomoles P-450/mg protein						No. 7	
	Fundulus			Brown Shrimp				
	No. 5	No. 6	No. 7	No. 5	No. 6	No. 7		
1B	.100 ± .08	Anoxia	.121 ± .02	.077 ± .01	Anoxia	.081 ± .04		
2B	.149 ± .01	.160 ± .03	.142 ± .04	.027 ± .01	.024 ± .01	.021 ± .01		
3B	.126 ± .01	Anoxia	.138 ± .06	.046 ± .01	Anoxia	.032 ± .01		
4B	.073 ± .01	.145 ± .02	.127 ± .01	.036 ± .01	.037 ± .01	.031 ± .02		
5B	.232 ± .01	.143 ± .02	.169 ± .03	.051 ± .01	.044 ± .01	.028 ± .03		
6B	.114 ± .01	.132 ± .02	.122 ± .01	.121 ± .02	.033 ± .01	.072 ± .01		
7B	.068 ± .01	.128 ± .03	.098 ± .03	.049 ± .01	.044 ± .01	.039 ± .01		
8B	.137 ± .01	Anoxia	.184 ± .01	.223 ± .02	Anoxia	.167 ± .01		
3P	.211 ± .14	.143 ± .01	.110 ± .03	Not in P-BOMS				
8P	.325 ± .01	.140 ± .01	.116 ± .02	Not in P-BOMS				
RF	.202 ± .12	.195 ± .04	.184 ± .05	.029 ± .01	.058 ± .02	.036 ± .01		
Mean of Means	.154	.148	.137	.079	.04	.055		

TABLE 11

Mean Levels of ATPase in *Fundulus* (liver) and Brown Shrimp (abdominal muscle)
 Exposed in P-BOMs and B-BOMs
 Survey Nos. 5 and 6 Data Compared with Survey No. 7

Station	ATPase Units $\times 10^{-2}$ /mg protein					
	Fundulus			Brown Shrimp		
	No. 5	No. 6	No. 7	No. 5	No. 6	No. 7
1B	3.47 ± .78	Anoxia	4.49 ± 1.24	8.81 ± 1.9	Anoxia	9.16 ± .84
2B	4.94 ± 2.02	4.00 ± 1.28	3.97 ± .62	8.27 ± 2.56	6.38 ± 1.36	7.56 ± 1.90
3B	4.52 ± 1.44	Anoxia	3.98 ± .67	8.19 ± .84	Anoxia	8.50 ± 1.15
4B	4.55 ± .55	4.66 ± .13	4.46 ± 1.60	7.09 ± 1.67	7.17 ± 1.07	7.79 ± 1.30
5B	4.35 ± 1.43	5.55 ± .82	4.47 ± .68	5.77 ± 1.30	5.84 ± 1.34	6.91 ± 1.32
6B	4.42 ± 1.58	3.86 ± 1.14	3.82 ± .61	8.99 ± 2.90	9.48 ± .80	9.12 ± .13
7B	3.58 ± 1.22	3.50 ± .61	3.63 ± .54	7.44 ± 1.32	7.30 ± .76	7.51 ± .61
8B	4.16 ± 1.38	Anoxia	3.95 ± .51	7.42 ± 1.36	Anoxia	7.60 ± 1.67
3P	3.88 ± .39	2.28 ± .45	3.78 ± .93	---Not in P-BOMs---		
8P	4.93 ± .90	4.88 ± .97	5.44 ± 1.37	---Not in P-BOMs---		
RF	4.36 ± 2.76	4.42 ± 1.19	4.21 ± 1.62	6.42 ± 1.32	6.88 ± .48	7.16 ± 1.19
Mean of Means	<u>4.28</u>	<u>4.14</u>	<u>4.20</u>	<u>7.75</u>	<u>7.18</u>	<u>8.01</u>

TABLE 12
 Mean Levels of Catalase in *Fundulus* (liver) and Brown Shrimp (abdominal muscle)
 Exposed in P-BOMs and B-BOMs
 Survey Nos. 5 and 6 Data Compared with Survey No. 7

Station	Catalase Units $\times 10^{-2}$ /mg protein						Brown Shrimp	
	<i>Fundulus</i>			No. 5				
	No. 5	No. 6	No. 7	No. 5	No. 6	No. 7		
1B	1.64 ± .28	Anoxia	2.20 ± .93	BDL	Anoxia	BDL		
2B	2.10 ± .42	2.44 ± .78	2.06 ± .07	BDL	BDL	BDL		
3B	2.30 ± 1.05	Anoxia	1.51 ± .32	BDL	Anoxia	BDL		
4B	2.43 ± .53	1.47 ± .27	1.58 ± .42	BDL	BDL	BDL		
5B	1.45 ± .20	1.73 ± .38	1.67 ± .08	BDL	BDL	BDL		
6B	1.96 ± .14	2.41 ± .27	1.86 ± .37	BDL	BDL	BDL		
7B	1.74 ± .55	1.78 ± .19	1.40 ± .34	BDL	BDL	BDL		
8B	1.52 ± .17	Anoxia	1.50 ± .49	BDL	Anoxia	BDL		
3P	1.50 ± .19	2.05 ± .57	1.66 ± .68	-----Not in P-BOMs-----				
8P	1.57 ± .24	1.49 ± .26	1.61 ± .52	-----Not in P-BOMs-----				
RF	2.12 ± .19	2.20 ± .47	1.75 ± .13	BDL	BDL	BDL		
Mean of Means	<u>1.82</u>	<u>1.94</u>	<u>1.71</u>					

V. SUMMARY CONCLUSIONS

1. LOOP Survey No. 7 was carried out by TerEco and LOOP personnel during the period from April 15 to 20, 1982. Eight B-BOMs and two P-BOMs were deployed at the established eight sampling stations (Figure 1).
2. Hydrographic conditions were somewhat unusual during the period in that salinities and temperatures were unusually low for the period and dissolved oxygen concentrations were the highest observed during the entire study.
3. The excellent environmental conditions were reflected in the fact that we collected indigenous species of organisms in every B-BOM and in very significant numbers.

APPENDIX A

WATER CHEMISTRY DATA

LOOP SURVEY VII

APRIL 1982



SHILSTONE ENGINEERING TESTING LABORATORY, INC.



ATLANTA, GEORGIA ZIP CODE 30306 600 VIRGINIA AVE., N.E. PHONE (404) 872 0795	MONROE, LA ZIP CODE 71201 315 N SECOND ST PHONE (318) 387-2327	NEW ORLEANS, LA ZIP CODE 70112 814 CONTIST PHONE (504) 524 8395	AUSTIN, TEXAS ZIP CODE 78723 1916 TILLERY ST. PHONE (512) 477-3738	BEAUMONT, TEXAS ZIP CODE 77705 2480 W. CARDINAL DR. #2 PHONE (713) 842 1020	CORPUS CHRISTI, TEXAS ZIP CODE 78416 810 S. PADRE ISLAND DR PHONE (512) 854 4801	
FAGLE PASS, TEXAS ZIP CODE 78852 RT. 2 BOX 4917 PHONE (512) 773-3717	FREEPORT, TEXAS ZIP CODE 77541 415 NORTH AVENUE F PHONE (713) 233-6366	HARLINGEN, TEXAS ZIP CODE 78550 210 N. "I" STREET PHONE (512) 423-6826	HOUSTON, TEXAS ZIP CODE 77007 1714 MEMORIAL DR PHONE (713) 224 2047	LAREDO, TEXAS ZIP CODE 78041 2908 SAN BERNARDO PHONE (512) 727-3702	SAN ANTONIO, TEXAS ZIP CODE 78216 8430 WESTERN BLVD PHONE (512) 342 9377	VICTORIA, TEXAS ZIP CODE 77901 402 E. STEPHENSON DR PHONE (512) 575 0281

TESTED FOR: LOOP, Inc.
P. O. Box 1159
Harvey, Louisiana 70058

PROJECT: Water Analysis

DATE: 5/4/82

OUR REPORT NO.: 253-03200-228

REMARKS:

DATE RECEIVED:

April 16, 1982.

SAMPLE IDENTIFICATION:

Six (6) water samples.

ANALYSIS REQUIRED:

Calcium, Oil and Grease, Silica, Total Solids, Total Dissolved Solids, Total Suspended Solids, Salinity, Nitrate, Ammonia, Total Kjeldahl Nitrogen, Sulfate, Chloride, Phenolphthalein Alkalinity, Total Alkalinity, Ortho Phosphate, Total Phosphate and Turbidity.

RESULTS:

Please see attached sheets.

/vmy

OFFICES OF AFFILIATED CORPORATIONS:

ALBANY, AUGUSTA, COLUMBUS, GA; CARBONDALE, CHAMPAIGN, DOWNS GROVE (CHICAGO), EAST PEORIA, SPRINGFIELD, IL; FT. WAYNE, TERRE HAUTE, WEST LAFAYETTE, IN; ANN ARBOR, DETROIT, FLINT, LANSING, MI; CHARLOTTE, NC; COLUMBUS, LIMA, OH; COLUMBIA, FLORENCE, SC

11805M

QUALITY CONTROL DATA:

Parameter	True Value	Result	Percent Recovery	Analyst	Date
Sulfate, ppm	1000	974	97	NR	4/19/82
Nitrate, ppm	1.0	0.78	78	NR	4/20/82
Calcium, ppm	1000	980	98	NR	4/19/82
Chloride, ppm	500	511	102	NR	4/20/82
Oil and Grease	50	45	90	FP	4/22/82
TSS, ppm	100	90	90	TP	4/16/82
Salinity, ppt	500	511	102	SE	4/22/82
Ammonia, ppm	10	10	100	SP	4/19/82
Alkalinity, ppm	100	97	97	TP	4/19/82
Phosphate, ppm	50	55	110	SP	4/9/82
Turbidity, NTU	10	9.9	99	TP	4/28/82
Silica	40.0	40.4	101	SE	5/3/82

LOOP, INC.

PAGE NO. 3
REPORT NO. 253-03200-228

<u>SAMPLE IDENTIFICATION</u>	<u>DATE</u>	CALCIUM AS Ca mg/L ppm	OIL AND GREASE mg/L ppm	SILICA AS Si mg/L ppm	TOTAL	DISSOLVED	TOTAL	SUSPENDED SOLIDS mg/L ppm
					mg/L ppm	mg/L ppm	mg/L ppm	mg/L ppm
82 SS 192 Bom Site 8 Bottom	4/15/82	312	BDL	ND	31,120	31,115	5	
82 SS 192 Bom Site 8 Top	4/15/82	280	BDL	ND	25,800	25,786	14	
82 SS 193 Bom Site 1 Bottom	4/15/82	296	BDL	ND	31,412	31,403	9	
82 SS 193 Bom Site 1 Top	4/15/82	304	BDL	ND	25,924	25,922	2	
82 SS 194 Bom Site 3 Bottom	4/15/82	304	14	ND	31,793	31,788	5	
82 SS 194 Bom, Site 3 Top	4/15/82	264	6	ND	25,790	25,776	14	

NOTES: BDL = Below Detection Limit, less than 5 ppm.

ND = None Detected, less than detection limit.

DETECTION LIMIT

Silicon -- 1.0 ppm

<u>SAMPLE IDENTIFICATION</u>	<u>DATE</u>	<u>TOTAL</u>	<u>AMMONIA</u>	<u>NITRATE</u>	<u>SULFATE</u>	<u>CHLORIDE</u>
		<u>KJELDAHL</u>	<u>AS N</u>	<u>AS N</u>	<u>AS SO₄</u>	<u>mg/L</u>
		<u>mg/L</u>	<u>mg/L</u>	<u>mg/L</u>	<u>mg/L</u>	<u>ppm</u>
		<u>ppm</u>	<u>ppm</u>	<u>ppm</u>	<u>ppm</u>	<u>ppm</u>
82 SS 192 Bom Site 8 Bottom	4/15/82	30.18	ND	.59	1.78	2160
82 SS 192 Bom Site 8 Top	4/15/82	24.94	ND	.30	.89	1730
82 SS 193 Bom Site 1 Bottom	4/15/82	29.75	ND	.45	.75	2020
82 SS 193 Bom Site 1 Top	4/15/82	24.94	.1	1.63	6.67	1750
82 SS 194 Bom Site 3 Bottom	4/15/82	29.75	ND	.30	.60	2020
82 SS 194 Bom Site 3 Top	4/15/82	23.91	.25	.30	1.34	1690
						11,759

NOTE: ND = None Detected, less than detection limit.

DETECTION LIMIT

Nitrate -- 0.1 ppm

Ammonia -- 0.02 ppm

Nitrogen -- 0.1 ppm

LOOP, INC.

PAGE NO. 5
REPORT NO. 253-03200-228

<u>SAMPLE IDENTIFICATION</u>	<u>DATE</u>	TOTAL ALKALINITY	ORTHO PHOSPHATE	TOTAL AS PO ₄	TURBIDITY
		AS CaCO ₃ mg/L ppm	AS PO ₄ mg/L ppm	AS PO ₄ mg/L ppm	NTU
82 SS 192 Bom Site 8 Bottom	4/15/82	25	101	ND	2.4
82 SS 192 Bom Site 8 Top	4/15/82	51	100	ND	3.0
82 SS 193 Bom Site 1 Bottom	4/15/82	31	105	ND	1.6
82 SS 193 Bom Site 1 Top	4/15/82	31	99	ND	3.1
82 SS 194 Bom Site 3 Bottom	4/15/82	23	105	ND	1.6
82 SS 194 Bom Site 3 Top	4/15/82	38	103	ND	3.0

NOTE: ND = None Detected, less than detection limit.

DETECTION LIMIT

Phosphate -- 0.2 ppm



SHILSTONE ENGINEERING TESTING LABORATORY, INC.



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EAGLE PASS, TEXAS ZIP CODE 78852 RT 2 BOX 4917 PHONE (512) 773 3717	FREEPORT, TEXAS ZIP CODE 77541 415 NORTH AVENUE F PHONE (713) 233 6366	HARLINGEN, TEXAS ZIP CODE 78550 210 N "T" STREET PHONE (512) 423 6826	HOUSTON, TEXAS ZIP CODE 77007 1714 MEMORIAL DR PHONE (713) 224 2047	LAREDO, TEXAS ZIP CODE 78041 2908 SAN BENITO DR PHONE (512) 727 3702	SAN ANTONIO, TEXAS ZIP CODE 78216 8430 WESTERN BLVD PHONE (512) 342 9377	VICTORIA, TEXAS ZIP CODE 77901 402 E. STEPHENSON DR PHONE (512) 575 0281

TESTED FOR: Loop, Inc.
P.O. Box 1159
Harvey, LA 70058
Attn: Mr. A.J. Heikamp, Jr.

PROJECT: Water Analysis

DATE: 5/5/82 OUR REPORT NO.: 253-03200-230

REMARKS:

DATE RECEIVED:

April 19, 1982

SAMPLE DESCRIPTION:

Water

ANALYSIS REQUIRED:

Calcium, Oil and Grease, Silica, Total Solids, Total Dissolved Solids, Total Suspended Solids, Salinity, Nitrate, Ammonia, Total Kjeldahl Nitrogen, Sulfate, Chloride, Phenolphthalein Alkalinity, Total Alkalinity, Ortho Phosphate, Total Phosphate, Turbidity.

RESULTS:

Please see following pages.

/cmm

OFFICES OF AFFILIATED CORPORATIONS:
ALBANY, AUGUSTA, COLUMBUS, GA; CARBONDALE, CHAMPAIGN, DOWNSERS GROVE (CHICAGO), EAST PEORIA, SPRINGFIELD, IL; FT. WAYNE, TERRE HAUTE, WEST LAFAYETTE, IN; ANN ARBOR, DETROIT, FLINT, LANSING, MI; CHARLOTTE, NC; COLUMBUS, LIMA, OH; COLUMBIA, FLORENCE, SC
11805M

QUALITY CONTROL DATA:

*Note = Turbidity measured in units of NTU.

SAMPLE ID

Page 3

253-03200-23
Salinity
so/o
PPT

SAMPLE ID	Calcium as Ca mg/L, PPM	Oil and Grease mg/L PPM	Silica as Si mg/L PPM	Total Solids mg/L PPM	Total Dissolved Solids mg/L, PPM	Total Suspended Solids mg/L, PPM	Total Salinity so/o PPT		
								17,230	17,220
82SS - 198 a	4/16/82	Bottom	288	6	ND	28,550	28,545	5	26.99
82SS - 199	4/16/82	Top	176	BDL	ND	18,800	18,781	19	17.99
82SS - 199	4/16/82	Bottom	264	BDL	ND	26,780	26,776	4	25.69
82SS - 200	4/16/82	Top	216	BDL	ND	19,610	19,600	10	19.18
82SS - 200	4/16/82	Bottom	280	BDL	ND	28,250	28,243	7	27.72
82SS - 201	4/16/82	Top	232	12	ND	23,520	23,510	10	23.18
82SS - 201	4/16/82	Bottom	312	12	ND	29,970	29,957	13	28.97
82SS - 202	4/16/82	Top	224	15	ND	20,390	20,379	11	19.78
82SS - 202	4/16/82	Bottom	296	13	ND	29,310	29,299	11	28.02

SAMPLE ID	253-03200-2									
	Nitrate as N mg/L PPM	Ammonia as N mg/L PPM	Total Kjeldahl Nitrogen mg/L, PPM	Sulfate as SO ₄ mg/L PPM	Chloride as Cl mg/L PPM	Phenol- phthalein Alkalinity as CaCO ₃ mg/L, PPM	Total Alkalinity as CaCO ₃ mg/L, PPM	Total Alkalinity as CaCO ₃ mg/L, PPM	Total Alkalinity as CaCO ₃ mg/L, PPM	
82SS - 198 a	4/16/82	Top	.6	1.04	1.49	1,080	8,234	22	96	96
82SS - 198 a	4/16/82	Bottom	.2	1.34	1.93	1,930	13,333	27	102	102
32SS - 199	4/16/82	Top	.85	1.19	2.38	1,100	8,759	21	97	97
32SS - 199	4/16/82	Bottom	.10	1.19	2.23	1,890	12,659	23	102	102
32SS - 200	4/16/82	Top	.95	.45	1.35	1,280	10,064	20	97	97
32SS - 200	4/16/82	Bottom	.10	.74	1.33	2,230	13,709	23	108	108
32SS - 201	4/16/82	Top	.20	.15	.89	1,670	11,383	25	100	100
32SS - 201	4/16/82	Bottom	ND	.59	1.33	2,050	14,305	22	103	103
32SS - 202	4/16/82	Top	.30	.30	.89	1,480	9,659	24	96	96
32SS - 202	4/16/82	Bottom	.20	.30	.89	2,210	13,858	24	99	99

SAMPLE ID	Turbidity NTU mg/L PPM	Total Phosphate as PO ₄ mg/L, PPM
-----------	---------------------------------	---

SAMPLE ID	Ortho Phosphate as PO ₄ mg/L, PPM
-----------	---

82SS - 198 a	4/16/82	Top	ND	ND	ND	8.3
82SS - 198 a	4/16/82	Bottom	ND	ND	ND	1.95
82SS - 199	4/16/82	Top	ND	ND	ND	5.7
82SS - 199	4/16/82	Bottom	ND	ND	ND	2.0
82SS - 200	4/16/82	Top	ND	ND	ND	5.1
82SS - 200	4/16/82	Bottom	ND	ND	ND	1.9
82SS - 201	4/16/82	Top	ND	ND	ND	3.2
82SS - 201	4/16/82	Bottom	ND	ND	ND	7.0
82SS - 202	4/16/82	Top	ND	ND	ND	5.1
82SS - 202	4/16/82	Bottom	ND	ND	ND	2.9

*ND = None Detected, less than detection limits

Phosphate - 0.2ppm
 Nitrate - 0.1ppm
 Ammonia - 0.02ppm
 Nitrogen - 0.1ppm
 Oil and Grease - 5ppm
 Silicon - 1.0ppm

BDL = Below Detectable Limits



SHILSTONE ENGINEERING TESTING LABORATORY, INC.



ATLANTA, GEORGIA ZIP CODE 30306 600 VIRGINIA AVE . N.E. PHONE (404) 872-0785	MONROE, LA ZIP CODE 71201 315 N SECOND ST PHONE (318) 387-2327	X NEW ORLEANS, LA ZIP CODE 70112 814 CONTIST. PHONE (504) 524-8395	AUSTIN, TEXAS ZIP CODE 78723 1916 TILLERY ST PHONE (512) 477-3738	BEAUMONT, TEXAS ZIP CODE 77705 2480 W. CARDINAL DR #2 PHONE (713) 842-1020	CORPUS CHRISTI, TEXAS ZIP CODE 78416 810 S. PADRE ISL AND DR PHONE (512) 854-4801	
EAGLE PASS, TEXAS ZIP CODE 78852 RT. 2 BOX 4917 PHONE (512) 773-3717	FREEPORT, TEXAS ZIP CODE 77541 415 NORTH AVENUE F PHONE (713) 233-6366	HARLINGEN, TEXAS ZIP CODE 78550 210 N. "T" STREET PHONE (512) 423-6826	HOUSTON, TEXAS ZIP CODE 77007 1714 MEMORIAL DR PHONE (713) 224-2047	LAREDO, TEXAS ZIP CODE 78041 2908 SAN BERNARDO PHONE (512) 727-3702	SAN ANTONIO, TEXAS ZIP CODE 78216 8430 WESTERN BLVD PHONE (512) 342-9377	VICTORIA, TEXAS ZIP CODE 77901 402 E. STEPHENSON DR PHONE (512) 575-0281

TESTED FOR: LOOP, Inc.
P. O. Box 1159
Harvey, Louisiana 70058

PROJECT: Water Analysis

Attention: Mr. A. J. Heikamp, Jr.

DATE: 5/5/82

OUR REPORT NO.: 253-03200-231

REMARKS:

DATE RECEIVED:

April 20, 1982.

SAMPLE IDENTIFICATION:

Six (6) water samples.

ANALYSIS REQUIRED:

Calcium, Oil and Grease, Silica, Total Solids, Total Dissolved Solids, Total Suspended Solids, Salinity, Nitrate, Ammonia, Total Kjeldahl Nitrogen, Sulfate, Chloride, Phenolphthalein Alkalinity, Total Alkalinity, Ortho Phosphate, Total Phosphate and Turbidity.

RESULTS:

Please see attached sheets.

/vmy

OFFICES OF AFFILIATED CORPORATIONS:

ALBANY, AUGUSTA, COLUMBUS, GA; CARBONDALE, CHAMPAIGN, DOWNSERS GROVE (CHICAGO), EAST PEORIA, SPRINGFIELD, IL; FT. WAYNE, TERRE HAUTE, WEST LAFAYETTE, IN; ANN ARBOR, DETROIT, FLINT, LANSING, MI; CHARLOTTE, NC; COLUMBUS, LIMA, OH; COLUMBIA, FLORENCE, SC
11805M

QUALITY CONTROL DATA:

Parameter	True Value	Result	Percent Recovery	Analyst	Date
Oil and Grease, ppm	50	42	84	FP	4/26/82
Nitrate, ppm	1.0	1.05	105	NR	4/27/82
Sulfate, ppm	1000	976	98	NR	4/26/82
Ammonia, ppm	10	9	90	SP	4/23/82
Chloride, ppm	500	523	105	NR	5/3/82
Calcium, ppm	1000	920	92	RR	4/30/82
Alkalinity, ppm	100	96	96	TP	4/30/82
TSS, ppm	100	80	80	TP	4/30/82
Total Solids, ppm	100	90	90	TP	5/3/82
Turbidity, NTU	10	9.9	99	TP	4/27/82
Silica, ppm	40.0	40.4	101	SE	5/3/82

LOOP, INC.

PAGE NO. 3
REPORT NO. 253-03200-231

<u>SAMPLE IDENTIFICATION</u>	<u>DATE</u>	CALCIUM AS Ca mg/L ppm	OIL AND GREASE mg/L ppm	SILICA AS Si mg/L ppm	TOTAL	DISSOLVED	TOTAL	SUSPENDED
					SOLIDS mg/L ppm	SOLIDS mg/L ppm	SOLIDS mg/L ppm	SOLIDS mg/L ppm
82 SS 206, Top	4/19/82	264	BDL	1.0	23,240	23,220	20	
82 SS 206, Bottom	4/19/82	248	BDL	5.0	23,940	23,936	4	
82 SS 207, Top	4/19/82	236	BDL	1.0	23,730	23,723	7	
82 SS 207, Bottom	4/19/82	248	BDL	2.0	24,410	24,405	5	
82 SS 208, Top	4/19/82	288	BDL	BDL	23,960	23,958	2	
82 SS 208, Bottom	4/19/82	244	BDL	2.0	26,610	26,608	2	

NOTE: BDL = Below Detection Limit.

DETECTION LIMITS

Oil and Grease -- 5 ppm

Silica -- 1.0 ppm

LOOP, INC.

PAGE NO. 4
REPORT NO. 253-03200-231

<u>SAMPLE IDENTIFICATION</u>	<u>DATE</u>	<u>TOTAL</u>		<u>NITRATE</u>	<u>AMMONIA</u>	<u>KJELDAHL</u>	<u>SULFATE</u>	<u>CHLORIDE</u>
		<u>SALINITY</u>	<u>S 0/00</u>	<u>AS N</u>	<u>AS N</u>	<u>NITROGEN</u>	<u>AS SO₄</u>	<u>AS Cl</u>
		<u>mg/L</u>	<u>ppt</u>	<u>mg/L</u>	<u>ppm</u>	<u>mg/L</u>	<u>ppm</u>	<u>mg/L</u>
82 SS 206, Top	4/19/82	24.45		0.15	.59	1.33	1690	12,000
82 SS 206, Bottom	4/19/82	24.73		0.15	.74	1.78	1650	12,200
82 SS 207, Top	4/19/82	23.70		0.20	.45	1.64	1560	11,600
82 SS 207, Bottom	4/19/82	24.37		0.25	BDL	1.63	1750	12,000
82 SS 208, Top	4/19/82	24.07		0.25	.3	1.04	1700	11,800
82 SS 208, Bottom	4/19/82	26.99		0.20	.3	.89	2000	13,000

NOTE: BDL = Below Detection Limit.

DETECTION LIMITS

Nitrate --- 0.1 ppm

Ammonia --- .02 ppm

Nitrogen --- 0.1 ppm

LOOP, INC.

PAGE NO. 5
REPORT NO. 253-03200-231

SAMPLE IDENTIFICATION	DATE	TOTAL ALKALINITY	ORTHO PHOSPHATE	TOTAL PHOSPHATE	TURBIDITY NTU
		AS CaCO ₃ mg/L	AS PO ₄ mg/L	PO ₄ ppm	
82 SS 206, Top	4/19/82	25	103	BDL	4.1
82 SS 206, Bottom	4/19/82	26	105	BDL	3.8
82 SS 207, Top	4/19/82	27	103	BDL	4.3
82 SS 207, Bottom	4/19/82	23	102	BDL	4.1
82 SS 208, Top	4/19/82	26	104	BDL	3.0
82 SS 208, Bottom	4/19/82	23	103	BDL	4.0

NOTE: BDL = Below Detection Limit.

DETECTION LIMITS

Phosphate -- 0.2 ppm



SHILSTONE ENGINEERING TESTING LABORATORY, INC.



ATLANTA, GEORGIA ZIP CODE 30306 600 VIRGINIA AVE., N.E. PHONE (404) 872-0795	MONROE, LA ZIP CODE 71201 315 N SECOND ST. PHONE (318) 387 2327	X NEW ORLEANS, LA ZIP CODE 70112 814 CONTINENTAL PHONE (504) 524 8395	AUSTIN, TEXAS ZIP CODE 78723 1916 TILLERY ST. PHONE (512) 477 3738	BEAUMONT, TEXAS ZIP CODE 77705 2480 W CARDINAL DR. #2 PHONE (713) 842-1020	CORPUS CHRISTI, TEXAS ZIP CODE 78416 810 S PADRE ISLAND DR PHONE (512) 854 4801	
EAGLE PASS, TEXAS ZIP CODE 78852 RT. 2 BOX 4917 PHONE (512) 773 3717	FREEPORT, TEXAS ZIP CODE 77541 415 NORTH AVENUE F PHONE (713) 233 6366	HARLINGEN, TEXAS ZIP CODE 78550 210 N. "T" STREET PHONE (512) 423 6826	HOUSTON, TEXAS ZIP CODE 77007 1714 MEMORIAL DR PHONE (713) 224 2047	LAREDO, TEXAS ZIP CODE 78041 2908 SAN BERNARDO PHONE (512) 727 3702	SAN ANTONIO, TEXAS ZIP CODE 78216 8430 WESTERN BLVD. PHONE (512) 342 9377	VICTORIA, TEXAS ZIP CODE 77901 402 E STEPHENSON DR PHONE (512) 575 0281

TESTED FOR: LOOP, Inc.
P. O. Box 1159
Harvey, Louisiana 70058

PROJECT: Water Analysis

DATE: 5/6/82

OUR REPORT NO.: 253-03200-232

REMARKS:

DATE RECEIVED:

April 21, 1982.

SAMPLE IDENTIFICATION:

Ten (10) water samples.

ANALYSIS REQUIRED:

Calcium, Oil and Grease, Silica, Total Solids, Total Dissolved Solids, Total Suspended Solids, Salinity, Nitrate, Ammonia, Total Kjeldahl Nitrogen, Sulfate, Chloride, Phenolphthalein Alkalinity, Total Alkalinity, Ortho Phosphate, Total Phosphate, and Turbidity.

RESULTS:

Please see attached sheets.

/vmy

OFFICES OF AFFILIATED CORPORATIONS:

ALBANY, AUGUSTA, COLUMBUS, GA; CARBONDALE, CHAMPAIGN, DOWNERS GROVE (CHICAGO), EAST PEORIA, SPRINGFIELD, IL; FT. WAYNE, TERRE HAUTE, WEST LAFAYETTE, IN; ANN ARBOR, DETROIT, FLINT, LANSING, MI; CHARLOTTE, NC; COLUMBUS, LIMA, OH; COLUMBIA, FLORENCE, SC

11805M

QUALITY CONTROL DATA:

Parameter	True Value	Result	Percent Recovery	Analyst	Date
Oil and Grease, ppm	50	42	84	FP	4/23/82
Silicon, ppm	4.0	4.1	103	SE	4/28/82
Nitrate, ppm	1	1	100	NR	4/30/82
Sulfate, ppm	1000	999.12	100	NR	4/30/82
Chloride, ppm	500	523	105	NR	4/27/82
Calcium, ppm	10	9	90	NR	4/28/82
Total Solids, ppm	100	90	90	TP	5/3/82
TSS, ppm	100	80	80	TP	5/3/82
Alkalinity, ppm	100	96	96	TP	5/3/82
Turbidity, NTU	10	9.9	99	TP	5/4/82
Ammonia, ppm	10	9	90	SP	4/23/82
Silica, ppm	40.0	40.4	101	SE	5/3/82

<u>SAMPLE IDENTIFICATION</u>	<u>DATE</u>	CALCIUM AS Ca mg/L ppm	OIL AND GREASE mg/L ppm	SILICA AS Si mg/L ppm	TOTAL DISSOLVED SOLIDS mg/L ppm	TOTAL SUSPENDED SOLIDS mg/L ppm
82 SS 210, Bottom	4/20/82	328	BDL	2.0	31,420	31,417
82 SS 210, Top	4/20/82	264	BDL	BDL	24,470	24,466
82 SS 211, Bottom	4/20/82	280	BDL	BDL	26,500	26,495
82 SS 211, Top	4/20/82	240	BDL	2.0	24,350	24,336
82 SS 212, Bottom	4/20/82	320	BDL	BDL	33,490	33,486
82 SS 212, Top	4/20/82	264	BDL	BDL	24,220	24,215
82 SS 213, Bottom	4/20/82	296	BDL	BDL	27,470	27,469
82 SS 213, Top	4/20/82	224	BDL	BDL	23,230	23,229
82 SS 214, Bottom	4/20/82	304	BDL	6.0	27,730	27,727
82 SS 214, Top	4/20/82	256	BDL	2.0	23,140	23,136

NOTE: BDL = Below Detection Limit.

DETECTION LIMITS

Oil and Grease -- 5 ppm

Silica -- 1.0 ppm

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SAMPLE IDENTIFICATION	DATE	NITRATE		AMMONIA		TOTAL KJELDAHL NITROGEN		SULFATE AS SO ₄		CHLORIDE AS Cl	
		SALINITY S 0/00 ppt	mg/L ppm	AS N mg/L ppm	AS N mg/L ppm	mg/L ppm	mg/L ppm	mg/L ppm	mg/L ppm	mg/L ppm	ppm
82 SS 210, Bottom	4/20/82	31.34	.20	.59	.59	1.63	2220	15,581			
82 SS 210, Top	4/20/82	23.48	.25	.30	.30	1.04	1600	11,532			
82 SS 211, Bottom	4/20/82	25.83	.10	.90	.90	1.80	1780	12,730			
82 SS 211, Top	4/20/82	23.16	.20	.59	.59	1.45	1640	11,383			
82 SS 212, Bottom	4/20/82	32.20	BDL	.59	.59	0.89	2170	16,028			
82 SS 212, Top	4/20/82	23.34	.20	.30	.30	0.60	1750	11,461			
82 SS 213, Bottom	4/20/82	27.43	BDL	.30	.30	0.89	2120	13,560			
82 SS 213, Top	4/20/82	23.04	.20	.90	.90	1.35	1810	11,312			
82 SS 214, Bottom	4/20/82	27.86	BDL	.30	.30	0.75	2340	13,780			
82 SS 214, Top	4/20/82	27.58	.20	.30	.30	1.04	1760	13,631			

NOTE: BDL = Below Detection Limit.

DETECTION LIMITS

Nitrate -- 0.1 ppm

Ammonia -- 0.02 ppm

Nitrogen -- 0.1 ppm

<u>SAMPLE IDENTIFICATION</u>	<u>DATE</u>	<u>PHENOL-PHTHALEIN</u>	<u>ALKALINITY AS CaCO₃</u>	<u>TOTAL ALKALINITY AS CaCO₃</u>	<u>ORTHOPHOSPHATE AS PO₄</u>	<u>TOTAL PHOSPHATE AS PO₄</u>	<u>TURBIDITY NTU</u>
		<u>mg/L Ppm</u>	<u>mg/L Ppm</u>	<u>mg/L Ppm</u>	<u>mg/L Ppm</u>	<u>mg/L Ppm</u>	
82 SS 210, Bottom	4/20/82	21	97	97	BDL	BDL	2.2
82 SS 210, Top	4/20/82	31	97	97	BDL	BDL	2.9
82 SS 211, Bottom	4/20/82	37	101	101	BDL	BDL	2.4
82 SS 211, Top	4/20/82	35	101	101	BDL	BDL	3.5
82 SS 212, Bottom	4/20/82	29	101	101	BDL	BDL	2.0
82 SS 212, Top	4/20/82	33	99	99	BDL	BDL	2.5
82 SS 213, Bottom	4/20/82	23	97	97	BDL	BDL	1.8
82 SS 213, Top	4/20/82	33	99	99	BDL	BDL	3.0
82 SS 214, Bottom	4/20/82	35	101	101	BDL	BDL	4.4
82 SS 214, Top	4/20/82	28	88	88	BDL	BDL	2.3

NOTE: BDL = Below Detection Limit.

DETECTION LIMITS

Phosphate -- 0.2 ppm